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FCC
Test Report

FCC CFR 47 Part 15.207(c) and 15.231 COMPLIANCE
Including Part 15.109

Entone Technologies Limited
17F 10 Knutsford Terrace
Tsimshatsui, Hong Kong

Product:
RF/IR Remote Control
Model:
99-990120-00

FCC ID:	S4A99-990120-00
Test Report Number:	0940ETLrf231
Date of Report:	October 2, 2009

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Table of Contents

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General Information

Test Report Number:	0940ETLrf231
Date Product Tested:	October 1, 2009
Date of Report:	October 2, 2009
Applicant:	Entone Technologies Limited 17F 10 Knutsford Terrace Tsimshatsui, Hong Kong
Contact Person	Mark Evensen
Equipment Tested:	RF/IR Remote Control
Trade Name:	Entone URCplus
Model:	99-990120-00
Purpose Of Test:	To demonstrate the compliance of the RF/IR Remote Control, 99-990120-00, with the requirements of FCC CFR 47 Part 15 Rules and Regulations to the limits of Subpart C 15.207(c) and 15.231 using the procedure stated in ANSI C63.4-2003. Also including CFR 47 Part 15.109 for the digital device requirements while operating in IR mode only.
Frequency Range Investigated:	8 MHz to 4.5 GHz
FCC ID:	S4A99-990120-00
Test Site Locations:	Field Strength Measurement Facility: Atlas Compliance & Engineering, Inc. 726 Hidden Valley Road Royal Oaks, California 95076 Conducted Interference Measurement Facility: Atlas Compliance & Engineering, Inc. 1792 Little Orchard Street San Jose, California 95125
FCC Site Registration Number:	90452
Industry Canada File Number:	IC 4929
Test Personnel:	Bruce Smith EMC Engineer

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Test Equipment

The following list contains the test equipment that was utilized in making the measurements in this report.

Description	Model	Serial	Manufacturer	Calibration Due
Active Loop Antenna	6502	9108-2669	EMCO	9/3/11
BiLog Antenna	CBL6112B	2783	Schaffner	1/3/10
Horn Antenna	3115	9003-3340	EMCO	8/27/11
Pre amp 9 kHz – 2 GHz	CPA9231A	3259	Schaffner	11/19/09
Pre amp 1 – 26.5 GHz	8449B	3008A00910	HP	3/12/10
RF Cable	HPI160S	0002	Semflex	10/14/10
EMI Test Receiver 9 kHz - 2500 MHz	ESPC	DE15934	Rohde & Schwarz	7/31/11
EMI Receiver 100 Hz – 22 GHz	8566B	2542A13058 (IF) 2637A03426 (RF)	HP	3/12/10

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Test Configuration

Customer:	Entone Technologies Limited
Test Date:	October 1, 2009
Specification:	FCC Part 15.109 and Part 15.231 Limits, ANSI C63.4-2003 Methods

EUT Description / Note:

The EUT, 99-990120-00, a RF/IR Remote Control, was powered up with new batteries and in a continuous transmitting mode. The channel up key was taped closed and transmitting continuously. The EUT is battery powered therefore no conducted emissions testing was performed. The EUT operating frequency is 433.92 MHz.

The remote control is a hybrid radio frequency (RF) and infrared (IR) remote control. The antenna is build-in type. The antenna gain is less than 1 dBi. The remote control is powered by two pieces of AA-battery. The RF mode and IR mode of transmission is selected by user. The device automatically deactivates both the RF and IR transmitter within one second (typical 0.1 second) if no key is depressed.

Modulation scheme:

- On-Off Keying (OOK) , Manchester coding
- The transmitter generates peak power when the transmitter data is " 1 "
- The transmit power is zero when the data is " 0 "
- Bit duty cycle : 50% on , 50% off
- RF Transmission / frame pause ratio : 76 mS / 270 mS
- Maximum RF output power : 1mW (0 dBm)

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EUT Support Program

The EUT was constantly transmitting at 433.92 MHz an ‘up channel’ code. The EUT was tested through three orthogonal axes to determine the attitude that maximizes the emissions with the measurement antenna in horizontal and then vertical polarization. The EUT was also tested in an IR only mode to determine any unintentional emissions according to Part 15.109 requirements.

EUT Modifications for Compliance

There were no modifications performed on the EUT. The test results state the emission levels of the EUT in the condition as it was received on October 1, 2009.

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EUT Support Devices

Table 1 - Support Equipment Used For Test

Model:	Description:	S/N	FCC ID#
N/A			

I/O Ports and Cables

Table 2 - EUT Port Termination's

I/O Port	Cable Type	Length	Connector	Termination
Battery	N/A	N/A	N/A	New Batteries (2-AAA)

Table 3 - Host Port Termination's

I/O Port	Cable Type	Length	Connector	Termination
N/A				

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Equipment Under Test

The photographs below show the condition of the EUT for test.

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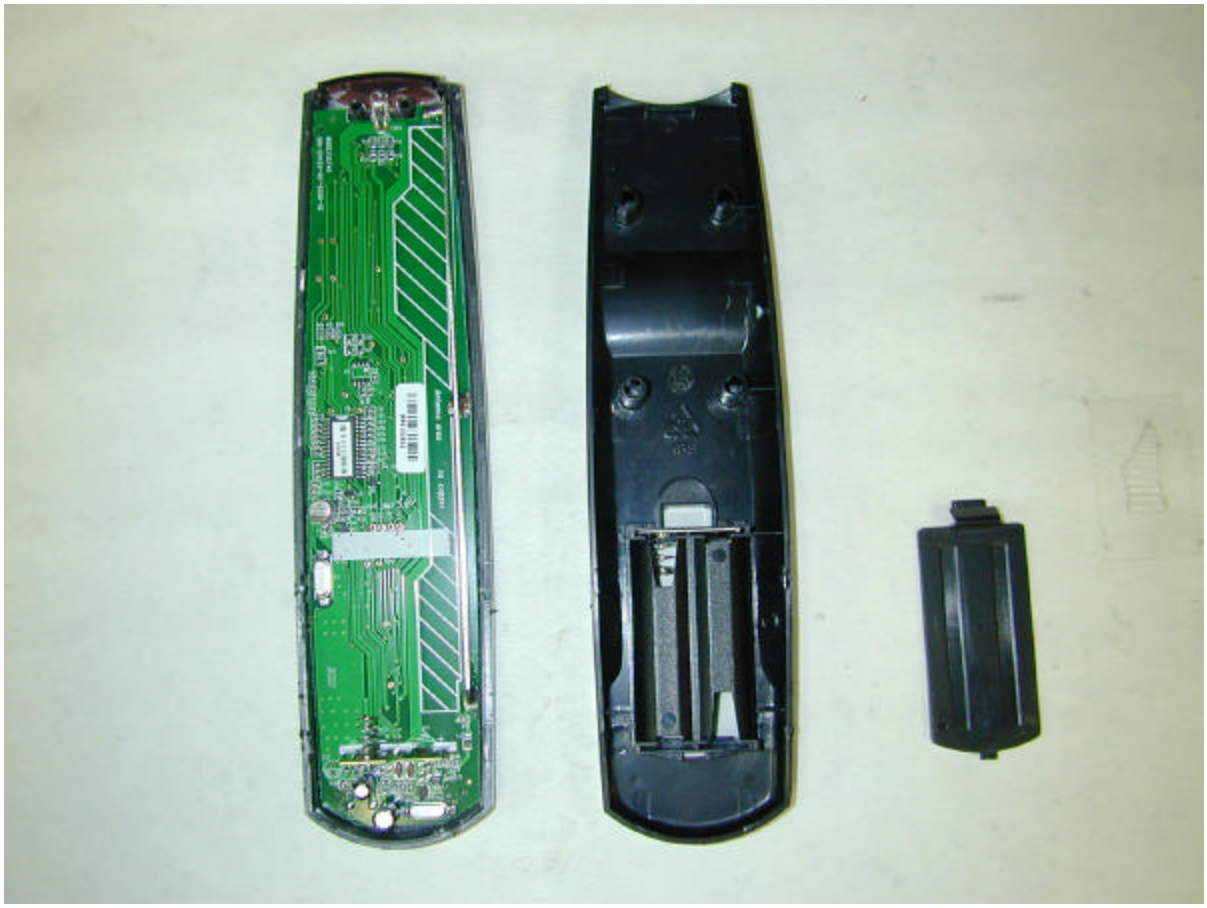

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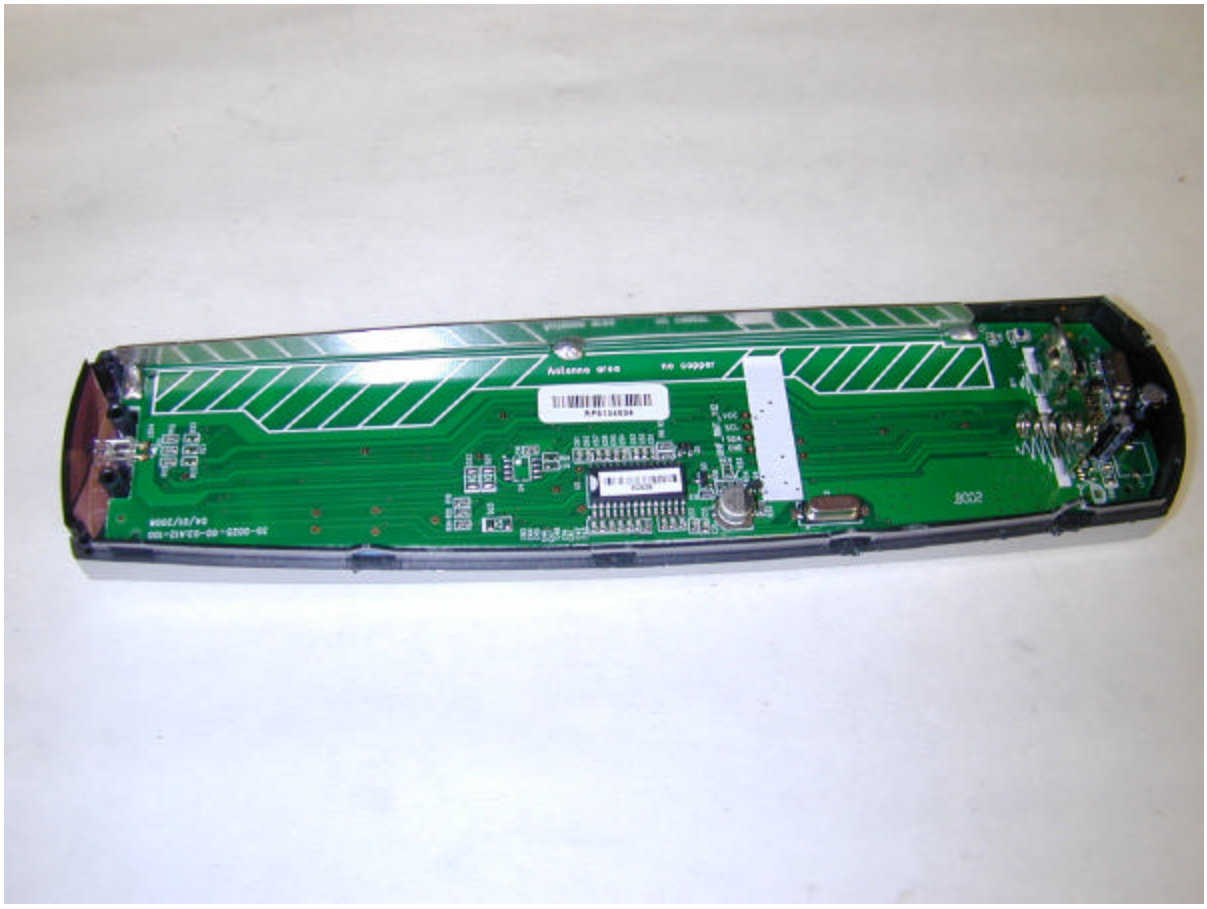

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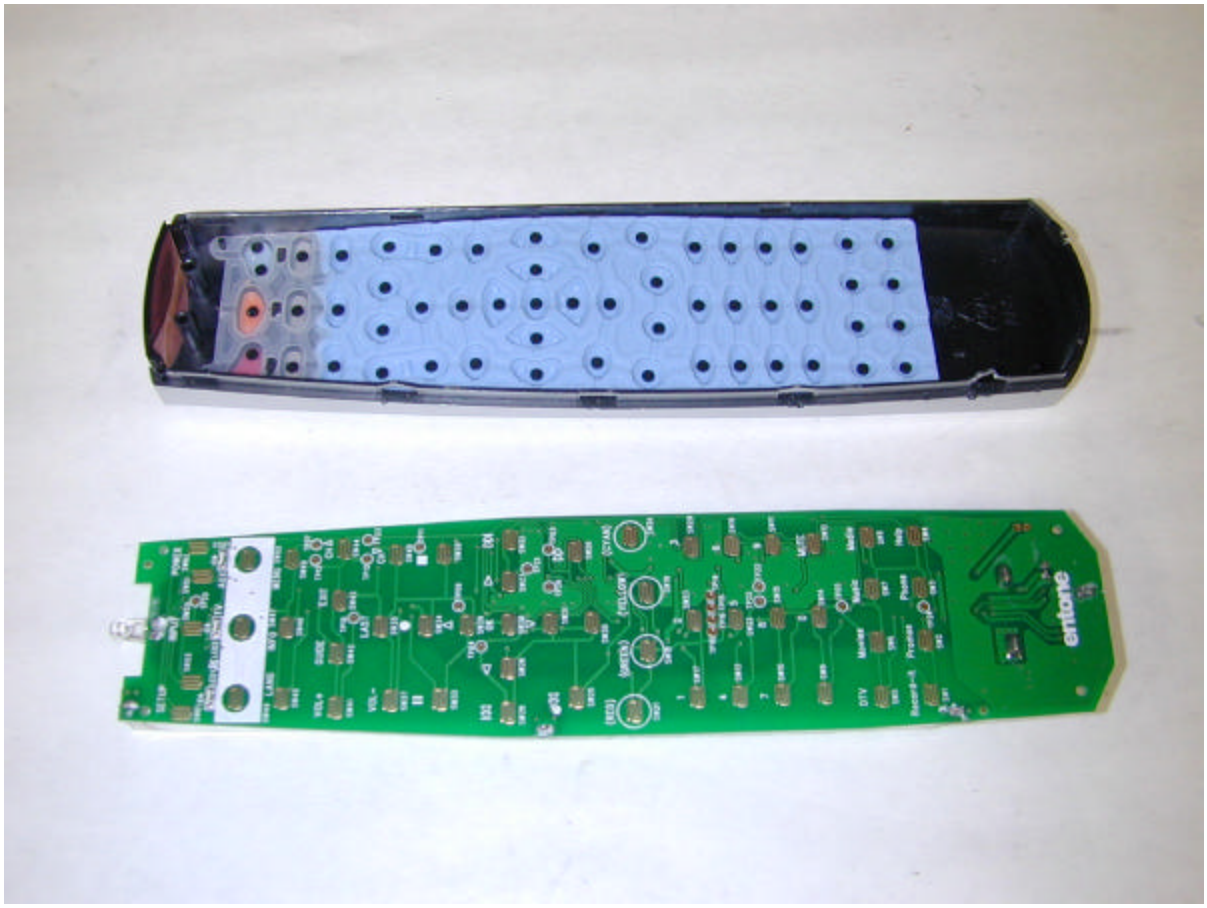

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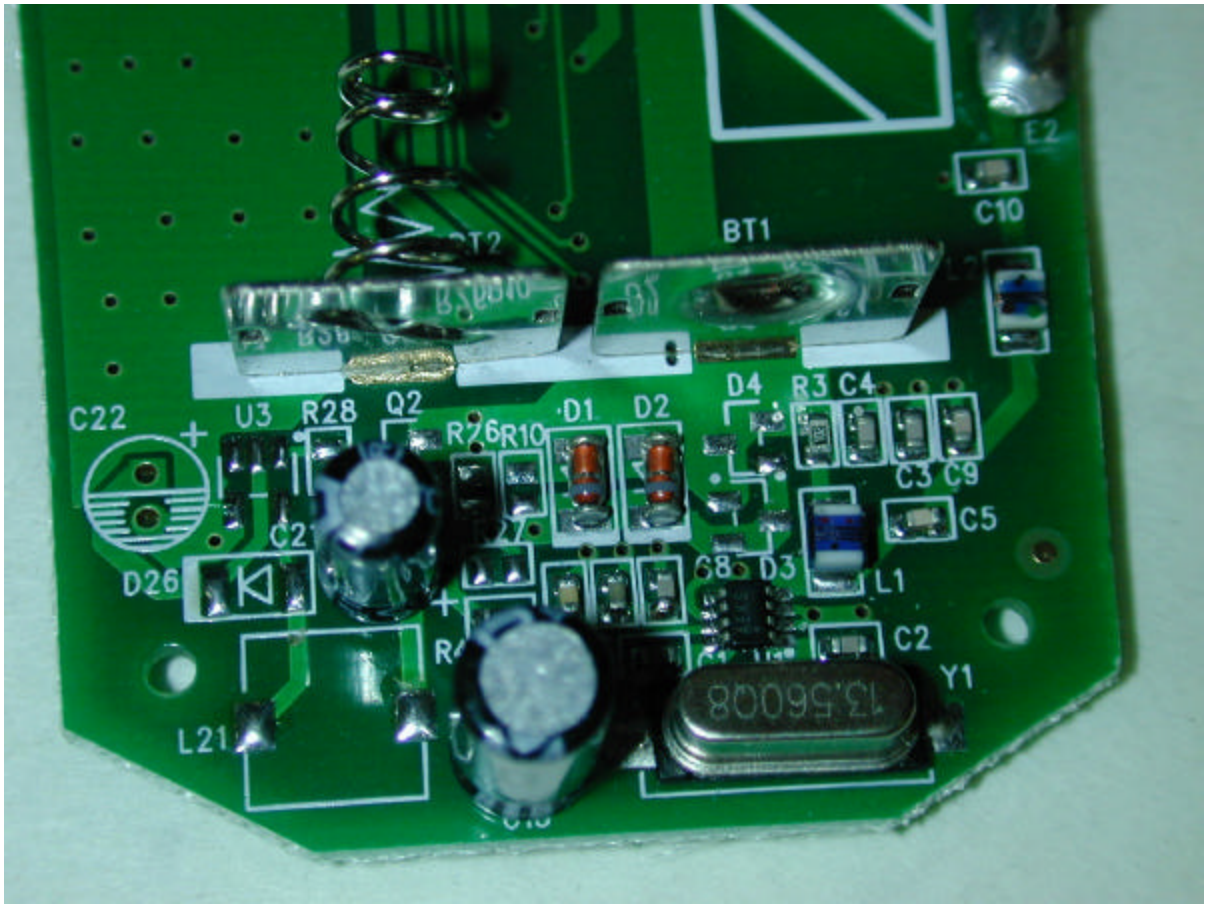

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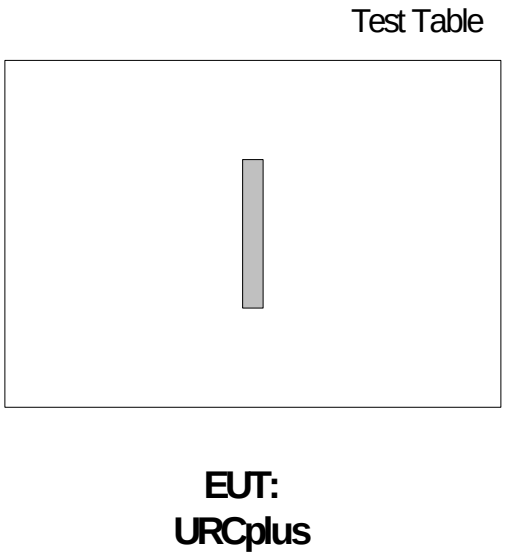
Equipment Block Diagram

Following is the block diagram of the test setup. Refer to TEST CONFIGURATION pages for port connections and information.

Figure 1 - Test Setup Diagram



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Test Setup (Radiated Emissions)

The photographs below show the test setup for radiated emission testing at 3-meter distance.

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Test Methods for Emissions

The test procedure stated in ANSI C63.4-2003 was used to collect the test data. The radiated emission data of the EUT was taken with the Rohde & Schwarz EMI Test Receiver or HP 8566B. Incorporating the application of correction factors programmed into the Test Receiver and verified for distance, antenna, cable loss, and amplifier gain, the data was reduced as shown in the Sample Calculations. These correction factors are available upon request. The corrected data was then compared to the FCC limits to determine compliance.

During radiated emission testing, the EUT was placed on a nonconductive rotating table 0.8 meter above the conductive grid. The nonconductive table dimensions were 1 meter deep by 1.5 meters wide at 0.8 meter high. The EUT is centered on the tabletop and the measurement antenna was placed 3 meters from the EUT as noted in the test data. The EUT, being a hand-held device, was tested in 3 orthogonal axes to determine which attitude produced the highest emission.

For radiated emissions testing, scans in the frequency range of 8 MHz to 4.5 GHz were made. Each frequency between 8 MHz and 30 MHz was measured at a bandwidth of 10 kHz, between 30 MHz and 1000 MHz was measured at a bandwidth of 100 kHz and between 1000 MHz and above was measured at a bandwidth of 1 MHz. Measurements were made employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz, and above 1GHz which employed a peak detector. All readings within 10 dB of the limits were recorded, and those emissions were then measured using the appropriate detector and bandwidth. Since the device uses OOK the averaging factor was calculate and added to the measured peak readings.

Measurements were made at a distance of 3 meters.

Conducted Emission Testing

The EUT is a battery powered device therefore no conducted emission testing was performed.

Section 15.207 Conducted limits.
(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

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Temperature and Humidity

The ambient temperature of the actual EUT was within the range of 10° to 40° C (50° to 104° F) unless the particular equipment requirements specify testing over a different temperature range. The humidity levels were within the range of 10% to 90% relative humidity unless the EUT operating requirements call for a different level.

Sample Calculations

An example of how the EMI Test Receiver reading is converted using correction factors is given for the emissions recorded in Table 7. These correction factors are programmed into the EMI Test Receiver and verified. For radiated emissions in dBµV/m, the EMI Test Receiver reading in dBµV is corrected by using the following formula: (example using reading at 1301.79 MHz)

66.9	Meter Reading (dBµV/m)
34.19	- Pre amp Gain (dB)
6.36	+ Cable Loss (dB)
24.84	+ Antenna Factor (dB)
-8.46	+ Averaging Factor (dB)
55.45	= Corrected Reading (dBµV/m)

This reading is then compared to the applicable specification limits and the difference will determine compliance.

55.45	Corrected Reading (dBµV/m)
60.8	- Limit (dBµV/m)
-5.35	= Margin (dBµV/m)

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FCC Part 15 Subpart C 15.207 and 15.209 Limits

Table 4 - Conducted Limits

Frequency MHz	Limit Quasi-Peak dBmV	Limit Average dBmV
0.15-0.50	66-56	56-46
0.50-5	56	46
5-30	60	50

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Both Quasi-Peak and Average limits for power line conducted testing must be met.
3. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Table 5 - Radiated Emission Limits, General Requirements

Frequency MHz	Field Strength mV/m	Measurement Distance Meters
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closest point of any part of the device or system.
3. The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.
4. The emission limits shown are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

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FCC Part 15 Subpart C 15.231 Limits

Table 6 - Radiated Emission Limits,
Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

Fundamental Frequency MHz	Field Strength of Fundamental microvolts/meter	Field Strength of Spurious Emissions microvolts/meter
40.66 - 40.70	2,250	225
70 – 130	1,250	125
130 – 174	1,250 to 3,750 **	125 to 375 **
174 – 260	3,750	375
260 – 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

NOTE: ** linear interpolations [Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

1. The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
2. Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.
3. The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

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Report of Measurements

Radiated emissions measurements were performed from 8 MHz to 30 MHz at 3-meter distance. The loop antenna was placed at 1-meter height and was rotated about its vertical axis. The EUT was also rotated 360 degrees in front of the antenna, all three orthogonal planes were scanned. No emissions were observed from the EUT in this frequency range for both operating modes of IR and RF.

Measurements were performed in the frequency range of 30 MHz to 1 GHz at 3-meter distance. The Bilog antenna was searched from 1 to 4 meters in height in both horizontal and vertical orientation. The EUT was also rotated 360 degrees in front of the antenna, all three orthogonal planes were scanned. No emissions were observed within 15dB of the limit other than the fundamental transmitter frequencies and the second harmonic while in the RF mode. No emissions were observed while operating in the IR mode.

Measurements were performed in the frequency range of 1 GHz to 4.5 GHz at 3-meter distance. The Horn antenna was searched from 1 to 4 meters in height in both horizontal and vertical orientation. The EUT was also rotated 360 degrees in front of the antenna, all three orthogonal planes were scanned. The third to tenth harmonics of the transmitter were measured and the levels recorded while operating in the RF mode. No emissions were observed in the IR mode.

Exploratory radiated emissions measurement of the transmitter frequency was made in all three orthogonal planes to determine the maximum transmit level of the EUT. The transmit frequency of 433.93 MHz was determined to be the highest level with the antenna in horizontal orientation and the EUT in the X-plane, as shown below. The highest level was recorded.

X-Plane

Y-Plane

Z-Plane

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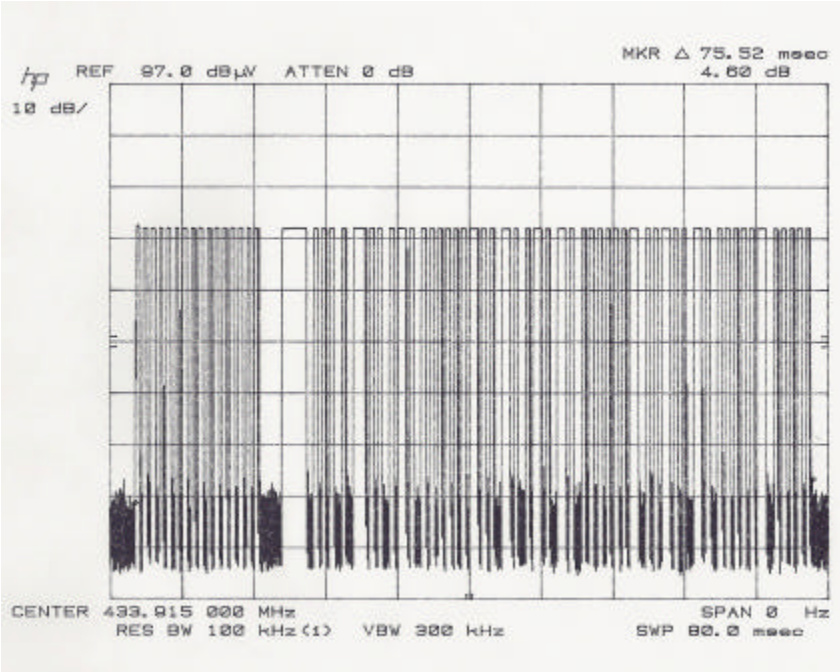
Pulsed Operation Averaging Factor



Pulse Train = 75.52mS

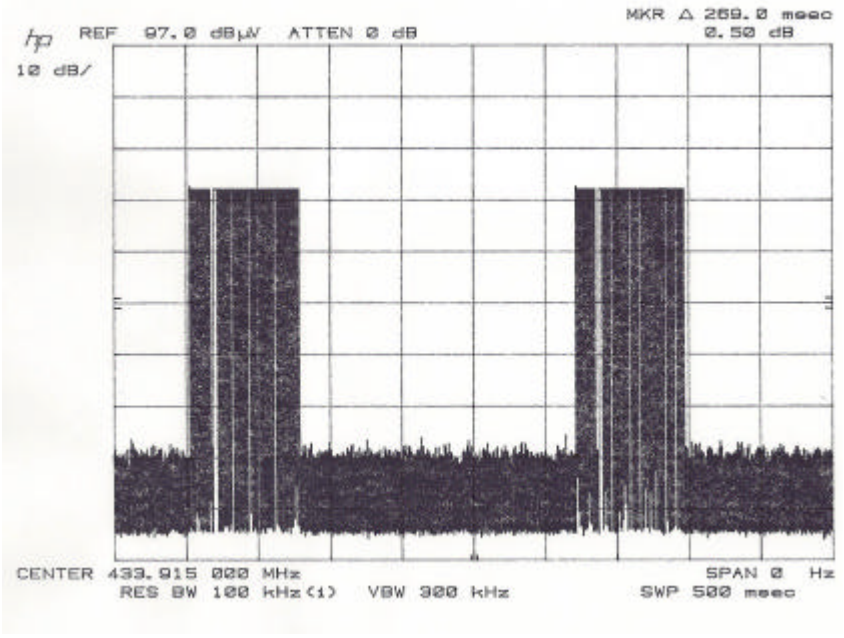
Manchester Coding

Repeat transmission = 269mS

Averaging Factor:

= 20LOG (75.52/2)/100

= -8.46 dB



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Report of Measurements Radiated Data

The following table reports the results of the radiated measurements for the RF/IR Remote Control, 99-990120-00.

Table 7 - Radiated Emission Level

15.231 Limit dBµV/m	Fundamental Frequency MHz	Level dBµV/m	Detector	Averaging Factor dB	Test Distance	Antenna	Polarity	Margin dB
80.8 @ 3 meters Tested un-modulated carrier to determine worst case orientation	433.92	90.09	PK	0	3	BiLog	H – X	9.29
		75.79	PK	0	3	BiLog	V – X	-5.01
	433.92	84.59	PK	0	3	BiLog	H – Y	3.79
		83.14	PK	0	3	BiLog	V – Y	2.34
	433.92	79.64	PK	0	3	BiLog	H – Z	-1.16
		88.79	PK	0	3	BiLog	V - Z	7.99

15.231 Limit dBµV/m	Frequency MHz	Level dBµV	Detector	Averaging Factor dB	Test Distance	Antenna	Polarity	Margin dB
80.8 @ 3 meters Averaging Factor -8.46dB	433.92	87.84	PK	-8.46	3	BiLog	H	-1.42
60.8 @ 3 meters	867.86	55.11	PK	-8.46	3	BiLog	H	-14.15
60.8 @ 3 meters	1301.79	63.91	PK	-8.46	3	Horn	H	-5.35
60.8 @ 3 meters	1735.72	54.96	PK	-8.46	3	Horn	H	-14.30
60.8 @ 3 meters	2169.65	50.21	PK	-8.46	3	Horn	H	-19.05
60.8 @ 3 meters	2603.58	47.14	PK	-8.46	3	Horn	H	-22.12
60.8 @ 3 meters	3037.51	48.48	PK	-8.46	3	Horn	H	-20.78
60.8 @ 3 meters	3471.44	51.98	PK	-8.46	3	Horn	H	-17.28
60.8 @ 3 meters	3905.37	55.29	PK	-8.46	3	Horn	H	-13.97
60.8 @ 3 meters	4339.30	54.39	PK	-8.46	3	Horn	H	-14.87
80.8 @ 3 meters Averaging Factor -8.46dB	433.92	72.34	PK	-8.46	3	BiLog	V	-16.92
60.8 @ 3 meters	867.86	49.61	PK	-8.46	3	BiLog	V	-19.65
60.8 @ 3 meters	1301.79	53.91	PK	-8.46	3	Horn	V	-15.35
60.8 @ 3 meters	1735.72	55.06	PK	-8.46	3	Horn	V	-14.20
60.8 @ 3 meters	2169.65	52.61	PK	-8.46	3	Horn	V	-16.65
60.8 @ 3 meters	2603.58	53.44	PK	-8.46	3	Horn	V	-15.82
60.8 @ 3 meters	3037.51	52.78	PK	-8.46	3	Horn	V	-16.48
60.8 @ 3 meters	3471.44	52.08	PK	-8.46	3	Horn	V	-17.18
60.8 @ 3 meters	3905.37	55.49	PK	-8.46	3	Horn	V	-13.77
60.8 @ 3 meters	4339.30	55.89	PK	-8.46	3	Horn	V	-13.37

Test Method: ANSI C63.4-2003
Spec Limit: FCC 15.231

Note: QP = Quasi-Peak
PK = Peak
AV = Average
H = Horizontal
V = Vertical

COMMENTS: System continuously transmitting a ‘channel up’ key press. Also tested in IR only mode. Ambient temperature 66°F and relative humidity of 45%. Test distance of 3 meters. No other emissions were observed between 8MHz and 4.5GHz.

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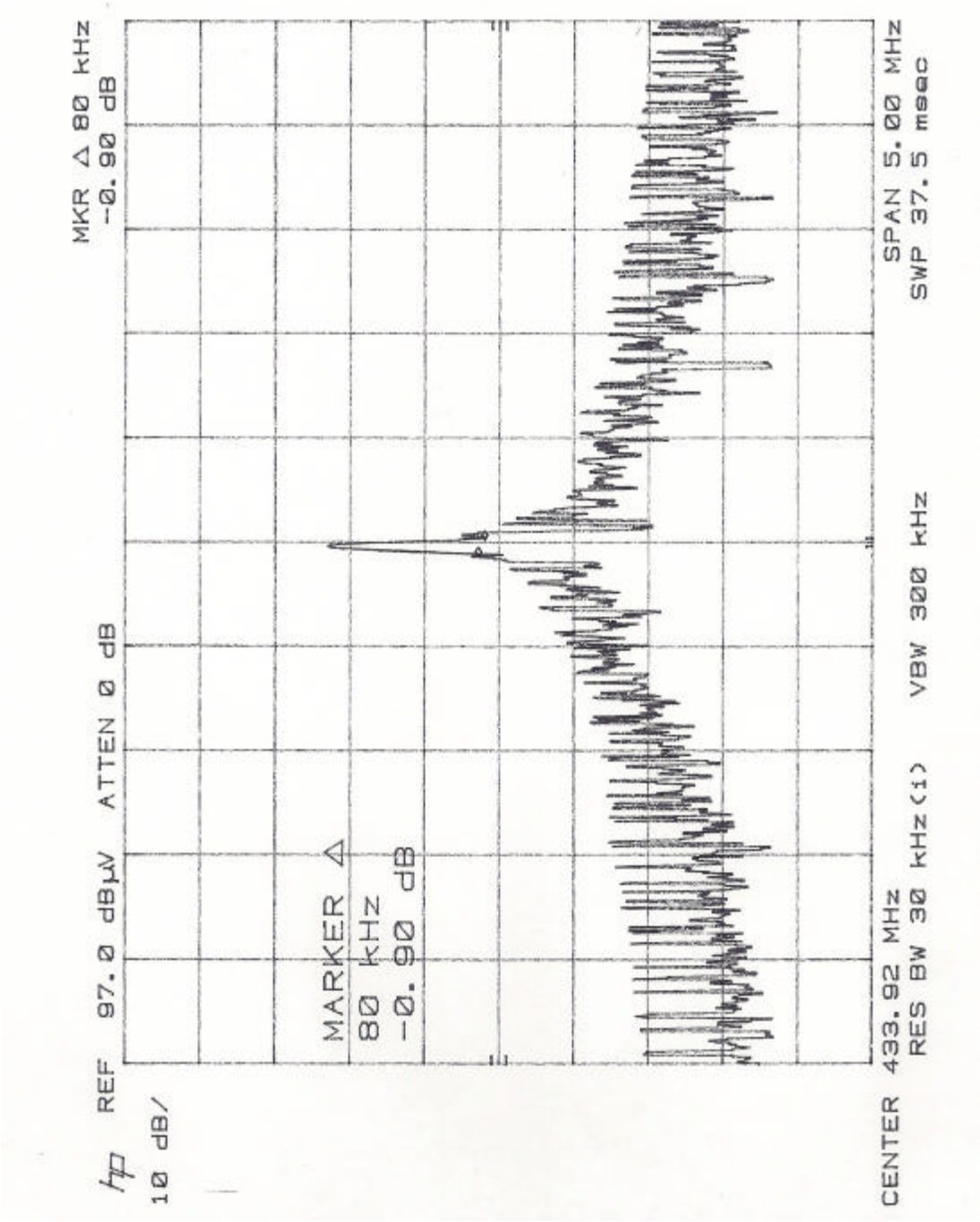
Report of Measurements Bandwidth

The following graph reports the results of the bandwidth measurements for the RF/IR Remote Control, 99-990120-00.

BW Limit = 0.25% of center frequency 433.92MHz
BW Limit = 1.08MHz, **20 dB BW Measured = 80 kHz**



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COMPLIANCE VERIFICATION REPORT

TEST CERTIFICATE

APPLICANT:	Entone Technologies Limited 17F 10 Knutsford Terrace Tsimshatsui, Hong Kong
Trade Name:	RF/IR Remote Control
Model:	99-990120-00

I HEREBY CERTIFY THAT:

The measurements shown in this report were made in accordance with the procedures indicated and that the energy emitted by this equipment, as received, was found to be within the FCC CFR 47 Part 15 Subpart C section 15.231 and 15.109 for Radiated emissions. Additionally, it should be noted that the results in this report apply only to the items tested, as identified herein.

I FURTHER CERTIFY THAT:

On the basis of the measurements taken at the test site, the equipment tested is capable of operation in compliance with the requirements set forth in FCC CFR 47 Part 15.109, 15.207(c) and 15.231 Rules and Regulations.

On this Date: October 1, 2009

Bruce Smith
Atlas Compliance & Engineering, Inc.

Printed Name

Signature
Entone Technologies Limited Representative